

Fluctuations and movements in a group of Lesser Flamingos *Phoeniconaias minor* in Kyambura Game Reserve, southwest Uganda

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In this century, the Greater and Lesser Flamingo *Phoenicopterus (ruber) roseus* and *Phoeniconaias minor* have been studied in great detail in East Africa (Jenkin 1957, Brown 1958, Brown & Root 1971, Brown *et al.* 1972, Din & Eltringham 1976). The species are known from nearly all of the Rift Valley lakes between Ethiopia and Tanzania. Brown (1975) estimated the East African population of Lesser Flamingos at 4 000 000 birds and the Greater Flamingo at 50 000. Though some well-known scientists and many amateurs have done an impressive amount of work, the movements of flamingos between the breeding lakes in Kenya and Tanzania (Brown 1975) and other alkaline lakes in eastern Africa are not fully understood.

Since 1906, Lesser Flamingos have been reported in the literature from Uganda, when breeding was reported on Lake Kikorongo in the Queen Elizabeth National Park (former Rwenzori National Park, cf. Din & Eltringham 1976). Pitman (1942) reported breeding attempts from 1936 and 1938 on Lake Kikorongo, but since then no breeding attempt has been reported.

During the two-month period between 14 July and 18 September 1994, population fluctuations and movements of the Lesser Flamingo were investigated between three alkaline lakes in Kyambura Game Reserve, southwest Uganda. The influence of the rainy season and rainfall on pattern of movements was examined.

Methods

Study site

Kyambura Game Reserve (30°08'E and 0°09'S) is located in south-west Uganda and serves as a buffer zone for the northern part of the Queen Elizabeth National Park (Fig. 1). Natural borders are the Kazinga Channel and Lake George in the north and the Kyambura Gorge in the west. To the east and south are plantations and villages. Mean altitude is 1150 m above sea-level and the annual level of rainfall is around 1000 mm. The Game Reserve covers an area of 156 km² consisting mainly of grassland, bush grassland and woodland in addition to small areas of swamp and lakeshores (Krüger & Johnson 1996). The Game Reserve has five main lakes, all of them crater lakes, but only Lake Maseche, Lake Bugusha and Lake Nshenyi are saline.

Lake Maseche is located a few hundred metres west of the western shore of Lake George in the eastern part of the Game Reserve. Its surface covers an area of *c.* 80 ha, varying in surface-size with rainfall more markedly than the other lakes. It has the lowest mean water level and in some years completely dries up (L. Nortje, pers. comm.). There are no steep crater walls around the lake.

Lake Bugusha is located 0.5 km west and 0.5 km south of Lake Maseche and covers a total of *c.* 110 ha. Its surface-size varies by only a few per cent between the seasons. It has steeper crater walls than Lake Maseche, which are up to 50 m high, and has the highest mean water level.

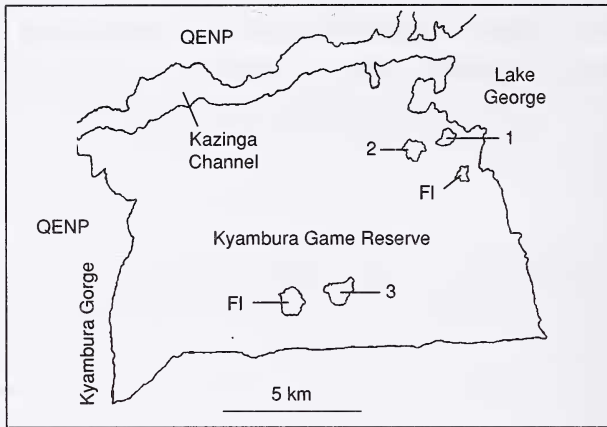


Figure 1. Map of Kyambura Game Reserve showing the five crater lakes. FI = freshwater lakes, QENP = Queen Elizabeth National Park, 1 = Lake Maseche, 2 = Lake Bugusha, 3 = Lake Nshenyi

Lake Nshenyi lies 6 km south of Lake Bugusha and 2 km north of the reserve boundary. The area covered by this lake is c. 170 ha, with a fluctuation in size and mean water level between that of Lake Maseche and Lake Bugusha. It has the steepest and highest crater walls, with an average height of 100 m.

The first report of Lesser Flamingos within Kyambura Game Reserve dates back to 1947, when Pitman (1949) found 100 individuals on Lake Maseche. Since then, some reports have been presented by Din & Eltringham (1976), who found a total number of 2351 on 25 September 1974 on the three lakes, with the largest group of 1847 on Lake Nshenyi.

Data collection

To determine the fluctuations in numbers of birds present in the reserve, flamingos on each of the three salt lakes were counted on one day, at least twice per month. Counting birds on each lake on the same day greatly reduced the chance of recording the same individual twice, because movements mainly take place at night (Brown 1975). Lake Maseche and Lake Bugusha were counted daily or at least twice per week to investigate the correlation between time since last rainfall and flamingo numbers. If both lakes were visited on one day, flamingo densities were lumped in the analysis to ensure independence of data points. Counts were made using 10 x 50 binoculars; numbers up to 100 were counted by individuals, up to 1000 by groups of 5 and above 1000 by groups of 10 flamingos. Counts lasted from minutes for small groups to more than two hours for the whole group on Lake Nshenyi. I determined the amount of rainfall visually and classified it as either low, moderate or heavy.

Results

Fluctuations of flamingos in the reserve

Figure 2 shows that the population decreased consistently between May and September 1994 ($r^2 = 0.79$, $df = 8$, $P < 0.001$; counts in May and June made by the Uganda Game Department). In April 1994, only between 1000 and 2000 flamingos were recorded, mostly on Lake Nshenyi and Lake Maseche (A. Brock-Doyle, pers. comm.). The steep rates of decrease were related to heavier rains in May (L. Nortje, pers. comm.) and the start of the rainy season in August. A strong relationship between decreasing numbers of flamingos and heavy rainfall has also been reported by Brown & Root (1971) and Din & Eltringham (1976).

This trend was not fully consistent, because some flamingos stayed on Lake Nshenyi and on Lake Kikorongo in the Queen Elizabeth National Park. Normally, the flamingos leave the reserve around September, but in 1993 and 1994 some remained (L. Nortje, pers. comm.).

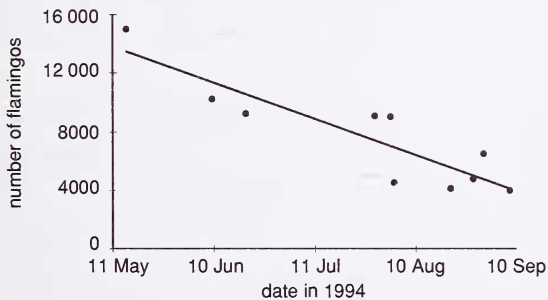


Figure 2. Decrease in the number of Lesser Flamingos between May 1994 and September 1994 in Kyambura Game Reserve, with regression line

Relationship between surface-size, rainfall and flamingo numbers

The mean densities of flamingos were significantly different between the three lakes (ANOVA, $F_{2,20} = 38.5$, $P < 0.001$, Fig. 3). The density on Lake Nshenyi was much higher than that on the other lakes, while there was no significant difference between Lake Bugusha and Lake Maseche (ANOVA, $F_{1,14} = 0.06$, $P = 0.82$). Lake Nshenyi held between 60% and 100% of the reserve's flamingos during the survey. The group on Lake Bugusha was almost always bigger than on Lake Maseche. The pattern of movements indicated that after rain the whole group of flamingos on Lake Maseche and Lake Bugusha, or a high percentage of it, flew to Lake Nshenyi. There was a significant positive correlation between the density of flamingos on Lake Bugusha or Lake Maseche and time since last rainfall ($r^2 = 0.80$, $df = 9$, $P < 0.001$, Fig. 4). Some indi-

viduals returned fairly quickly from Lake Nshenyi and the number on Lake Maseche and Lake Bugusha gradually increased as long as it stayed dry. The flamingos returned in discrete groups but in no case were more than 1200 observed either on Lake Maseche or Lake Bugusha.

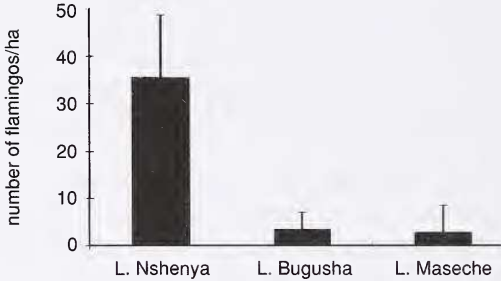


Figure 3. Mean densities of flamingos on the three alkaline lakes in Kyambura Game Reserve during the survey (error bars show one standard deviation)

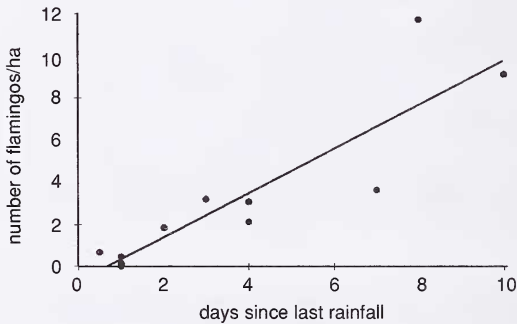


Figure 4. Density of flamingos on Lake Maseche or Lake Bugusha in relation to time since last rainfall in days, with regression line

Discussion

The size of the group of flamingos and the fact that some stayed in the reserve for the whole year are phenomena reported in 1936 and 1938 (Pitman 1942), and 1961 (Din & Eltringham 1976). In these years there were heavy rains or drought at the breeding and feeding lakes in Tanzania and Kenya which led to fluctuations of the water level and made these biotopes unsuitable (Brown & Root 1971). The number of flamingos in the reserve decreases soon after the rainy season starts. The reason is very likely food availability (Jenkin 1957, Brown 1975), with the birds moving to other lakes or to their

breeding grounds. However, the period of investigation was short and there is no direct evidence for changing food availability with rainfall, so firm conclusions cannot be drawn.

Din & Eltringham (1976) predicted that higher numbers of flamingos should be expected in the reserve in the 1990s, which is verified by this study. As Brown (1975) points out, a relationship seems to exist between rainfall, water alkalinity and food availability. The Lesser Flamingo has a narrow ecological niche with regard to its food, usually specializing on the cyanophyte *Spirulina* spp. (Jenkin 1957). The population density of *Spirulina* fluctuates with the alkalinity (Jenkin 1957). The dilution effect of rainfall might be particularly great in small lakes, explaining the movement in Kyambura from the smaller lakes to Lake Nshenyi after rain.

Another explanation why the largest group was found always on Lake Nshenyi might be protection from predation. Brown (1958) reported that African Fish Eagles *Haliaeetus vocifer* kill Lesser Flamingos as do Marabou Storks *Leptoptilos crumeniferus*, Spotted Hyaenas *Crocuta crocuta* and other predators. Access for mammals to Lake Nshenyi is more difficult than to the other lakes, because of the high crater walls. In addition, the density of African Fish Eagles and Marabou Storks is much higher at Lake Maseche and Lake Bugusha because the Kazinga Channel, where these species breed, is nearby (Krüger 1997). Nonetheless, at Lake Nshenyi two flamingos were killed by African Fish Eagles during the study.

Breeding attempts have been reported elsewhere in East Africa when the conditions at Lake Natron are unsuitable. Brown & Root (1971) report that security is a significant factor influencing breeding attempts, and the lakes in Kyambura Game Reserve are still relatively remote from human interference. But as Din & Eltringham (1976) point out, the small size of the lakes and the high density of predators like African Fish Eagles make it unlikely that flamingos can breed successfully here. However, in 1995 breeding attempts were made at Lake Maseche (A. Byaruhanga, pers. comm.).

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